

HSL No. 73-7
APRIL 13, 1973

THIS ISSUE CONTAINS:

HS-012 380 - HS-012 441
HS-800 725; 734; 753; 756; 764
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U.S. Department of
Transportation

National Highway
Traffic Safety
Administration



Shelve in stacks

S.B.T.

Highway Safety Literature

... A SEMI-MONTHLY ABSTRACT JOURNAL

AVAILABILITY OF DOCUMENTS

Documents listed in **Highway Safety Literature** are **not** available from the National Highway Traffic Safety Administration. They must be ordered from the sources indicated on the citations, usually at cost. Ordering information for each of the sources is listed below.

NTIS: National Technical Information Service, Springfield, Va. 22151. **Order by title and accession number: HS, AD, or PB.**

GPO: Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. **Give corporate author, title, personal author, and report number.**

Corporate Author: Contact corporate author.

Reference Copy Only: Consult your librarian.

Journal Citation: Obtain through normal loan or purchase.

SAE: Society of Automotive Engineers, Dept. HSL, 2 Pennsylvania Plaza, New York, N.Y. 10001. **Order by title and SAE report numbers.**

HRB: Highway Research Board, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418.

Material directly related to Highway and/or Motor Vehicle Safety is solicited for inclusion in Highway Safety Literature. Topics must fall within the scope of the Subject Fields and Groups listed on the inside front cover. Submit material, together with a written statement of approval for publication to:

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National Highway Traffic
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Documents containing several articles are announced as a complete volume in the subject category most applicable to it as a whole. Entries for individual articles are listed in their most specific category.

SAMPLE ENTRIES

Subject Categories		
NHTSA Accession No.	HS-800 218 Fld. 5/21; 5/9	HS-004 497 Fld. 5/19
Title of document	AN INVESTIGATION OF USED CAR SAFETY STANDARDS—SAFETY INDEX: FINAL REPORT. VOL. 6 — APPENDICES G-L	AUTO THEFT—THE PROBLEM AND THE CHALLENGE
Person(s) author(s)	by E. N. Wells; J. P. Fitzmaurice; C. E. Williams; S. R. Kalin; P. D. Williams	by Thomas A. Williams, Sr.
Corporate author	Operations Research, Inc.	Journal citation Published in <i>FBI Law Enforcement Bulletin</i> v37 n12 p15-7 (Dec. 1968)
Pagination		
Publication date	1969 150p Contract FH-11-6921 Report no. ORI-TR-553-Vol. 6; PB-190 523.	Gives figures on the extent of the auto theft problem and comments on anti-theft devices available now or in the planning stage.
Abstract	Appendices G-L to this study of used car safety standards include: indenture model diagrams for classes I-IV motor trucks; degradation, wear, and failure data for motor truck classes I-IV; and safety index tables for classes I-IV motor trucks. Search terms; Wear; Trucks; Failures; Used cars; Inspection standards	Search terms: Theft; Theft protection; Stolen cars (Note: If the date of a report or Journal article is not given, the small letters <u>nd</u> will appear)
Availability	NTIS	

NOTE: () Numbers in parentheses following certain subject groups indicate the Highway Safety Program Standards (No. 1 and up) and/or Federal Motor Vehicle Safety Standards (No. 101 and up) which may apply to these groups.

1/0 ACCIDENTS 1

- /1 Emergency Services (11, 15-16)
- /2 Injuries
- /3 Investigation (10, 14-15)
- /4 Locations (9, 14)
- /5 Statistical data

2/0 HIGHWAY SAFETY 10

- /1 Breakaway Structures
- /2 Communications
- /3 Debris Hazard Control and Cleanup (15-16)
- /4 Design and Construction (12, 14)
- /5 Lighting (14)
- /6 Maintenance (12)
- /7 Meteorological Conditions
- /8 Police Traffic Services (15)
- /9 Traffic Control (13-14)
- /10 Traffic Courts (7)
- /11 Traffic Records (10)

3/0 HUMAN FACTORS 10

- /1 Alcohol (8, 14)
- /2 Anthropomorphic Data
- /3 Cyclists
- /4 Driver Behavior
- /5 Driver Education (4, 14)
- /6 Driver Licensing (5, 10, 14)
- /7 Drugs Other Than Alcohol
- /8 Environmental Effects
- /9 Impaired Drivers
- /10 Passengers
- /11 Pedestrians (14-15)
- /12 Vision

4/0 OTHER SAFETY-RELATED AREAS 16

- /1 Codes and Laws (6)
- /2 Community Support (17)

- /3 Cost Effectiveness
- /4 Governmental Aspects
- /5 Information Technology
- /6 Insurance
- /7 Mathematical Sciences
- /8 Transportation Systems

5/0 VEHICLE SAFETY 17

*All Federal Motor Vehicle Safety Standards apply to passenger vehicles. An asterisk before a subject group indicates additional types of vehicles to which the indicated standards may apply.

- /1 Brake Systems (102, 105-6, 116)
- * /2 Buses, School Buses, and Multipurpose Passenger Vehicles (102-4, 106-8, 111-3, 116, 205-6, 209, 211)
- * /3 Cycles (3; 108, 112, 116, 205)
- /4 Design (14; 101-2, 105, 107, 201)
- /5 Door Systems (201, 206)
- /6 Fuel Systems (101, 301)
- /7 Glazing Materials (205)
- /8 Hood Latch Systems (113)
- /9 Inspection (1)
- /10 Lighting Systems (101, 105, 108, 112)
- /11 Maintenance and Repairs
- /12 Manufacturers, Distributors, and Dealers
- /13 Mirrors and Mountings (107, 111)
- /14 Occupant Protection (15; 201-4, 207-10)
- /15 Propulsion Systems
- /16 Registration (2, 10)
- /17 Safety Defect Control
- /18 Steering Control System (101, 107, 203-4)
- /19 Theft Protection (114-5)
- * /20 Trucks and Trailers (102-4, 107-8, 112-3, 116, 205-6, 209)
- /21 Used Vehicles
- /22 Wheel Systems (109-10, 211)
- /23 Windshield-Related (101, 103-4, 107, 205, 212)

1/0 ACCIDENTS

HS-012 431 Fld. 1/0

THE PROBLEM OF MOTOR VEHICLE ACCIDENTS: THE ROLE OF THE PHYSICIAN AND THE CHALLENGE TO MEDICINE. SUMMARY ADDRESS

by N. C. Kiefer

Equitable Life Assurance Society of the United States, E17850

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, p305-12

Summarizing statements on the conference sections are presented. They deal with accidents, emotional factors, special problems related to age groups, natural deaths, suicidal drivers, alcohol effects, and emergency medical services.

Search terms: Accident causes; Psychological factors; Age factor in accidents; Natural deaths; Suicide by vehicle; Alcohol effects; Emergency medical services; Physicians and highway safety

1/1 Emergency Services

HS-012 427 Fld. 1/1

COMPREHENSIVE AMBULANCE SERVICE FOR A CITY

by J. M. Waters, Jr.

Jacksonville Office of the Director of Public Safety, Fla., J00100

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p235-48

1971

The history and current status of the Jacksonville, Fla. emergency service is

described. Emphasis is made on the communication system, dispatching methods, emergency care, and training of personnel. Cost figures are given for the ambulance fleet. The service has been extended to include cardiac emergencies unrelated to highway accidents.

Search terms: Emergency medical services; Ambulances; Emergency reporting systems; Costs; Emergency training; Jacksonville (Fla.); Helicopters; Myocardial infarct

HS-012 428 Fld. 1/1

CRITERIA SELECTION IN EMERGENCY MEDICAL SYSTEM ANALYSIS

by R. B. Andrews

California Univ., Los Angeles, C18600

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p248-59

1971 21refs

The emergency medical care (EMC) process begins with recognizing what is a medical emergency. It includes all communications related to the incident, delivery of medical care to the scene, and transportation of the victim to an appropriate medical facility. It concludes with the medical and/or surgical alleviation of the emergency conditions. Finally, the victim may be released or transferred to a hospital for recovery or for treatment of residual nonemergency conditions. The components of a general evaluative model are the occurrence of emergency and emergency-like medical incidents; the outcome of true medical emergencies; the outcome of emergency-like medical incidents; the operational characteristics of the EMC system; and the total cost of creating and operating the EMC system.

Search terms: Emergency medical services; Cardiopulmonary responses;

Hemorrhage; Shock (pathology); Medical emergencies; Heart arrest; Asphyxia

HS-820 215 Fld. 1/1; 2/2

DISPATCHER. EMERGENCY MEDICAL TECHNICIAN TRAINING COURSE

National Hwy. Traf. Safety Administration, N19900

1972 27p

This instructor's guide to use of emergency communications systems contains seven lessons on ambulance dispatching, telephone techniques, voice techniques and use of the radiotelephone at a base station or in a mobile unit, law enforcement and defense civil preparedness communications, equipment, and a sample testing procedure. The course serves as an adjunct to the Department of Transportation's Basic Training Program for Emergency Medical Technician-Ambulance.

Search terms: Curricula; Emergency reporting systems; Emergency medical services; Communication systems; Telephones; Radiotelephones; Radio communication; Telecommunication; National defense; Speech; Radio dispatcher training

AVAILABILITY: GPO \$0.60

1/2 Injuries

HS-012 382 Fld. 1/2; 3/2; 5/14

EXPERIMENTAL INVESTIGATION ON INJURY MECHANISMS OF CERVICAL SPINE AT FRONTAL AND REAR-FRONT VEHICLE IMPACTS

by H. J. Clemens; K. Burow

De Gruyter Verlag (West Germany), D05200; Technische Univ., Berlin (West Germany), T08250

1/2 Injuries (Cont'd.)

HS-012 382 (Cont'd.)

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p76-104

1972 58refs

Report no. SAE-720960

The results of simulated head-on and rear-front vehicle crashes employing 53 human torsos are discussed. Measurements of deceleration of the head were taken, and the resulting injuries were noted. The most common and serious injury was to the cervical spine at the sixth vertebra. It is suggested that vehicle restraint systems be developed to avoid such injury, such as safety belts that would limit anteflexion of the head, air bags for head-on crash protection, and seat backs with integrated headrests to support the head at the center of gravity.

This study explores the application of viscoelastic modeling for characterization of the response of the brain to impulsive loading with the objective of learning whether such models could exhibit the same time dependency of strain or likelihood of injury, as exhibited by the Severity Index, HIC Index, and Wayne Tolerance Curve. The mathematical relationships between viscoelastic properties and the corresponding time dependency of tolerance are shown. Preliminary static and dynamic tests upon small mammalian material are described with particular attention given to strain in the vicinity of the brainstem as a function of loading profile. Both the theoretical and experimental results show that the falling time dependency of indexes can be interpreted in terms on nonlinear viscoelastic response.

Search terms: Viscoelasticity; Mathematical models; Head impact tolerances; Injury research; Injury severity index; Brain stem injuries; Logarithms; Scillographs; Creep;

matic areas of 900 lb, 450 lb, and 200 lb, respectively, are corroborated by additional data. Minimal force tolerances for most recent impact locations investigated could be described as follows: A-P mandible—400 lb, lateral mandible—200 lb, maxilla—150 lb, and zygomatic arch—200 lb. Females, as a group, tended to have a lower tolerance to applied force than did the male specimens. Unembalmed material showed no tendency to be weaker in general than embalmed material. In the range of pulse durations studied, there was no evidence to indicate that fracture tolerance to force decreases as pulse duration is increased.

Search terms: Injury research; Drop tests; Head impact tolerances; Skull fractures; Cadavers in testing; Test equipment; Injury severity; Impact forces; Impact caused injuries; Facial bone fractures; Injuries by sex

HS-012 388 Fld. 1/2; 1/3

INJURY MECHANISMS IN ROLL-OVER COLLISIONS

by P. V. Hight; A. W. Siegel; A. M. Nahum

California Univ., San Diego, C16400

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p204-27

1972 19refs

Report no. SAE-720966

Supported by the Public Health Services, Automobile Manufacturers Assoc., Inc., and National Hwy. Traf. Safety Administration.

Conclusions of a study of rollover collisions and the injuries resulting from them are presented. The injury severity, the type of injury, the body region injured, the frequency of injury, and the injury mechanism are all indicated. The study includes statistics on both restrained and unrestrained occupants, and

HS-012 387 Fld. 1/2

IMPACT STUDIES OF FACIAL BONES AND SKULL

by D. C. Schneider; A. M. Nahum

General Motors Corp., G06600; University Hosp., San Diego, Calif., U10300

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p186-203

1972 6refs

Report no. SAE-720965

The dynamic responses of the human skull and facial bones have been determined by a series of impact experiments. A total of 106 experiments were performed on 17 human cadavers. The specimens were both embalmed and unembalmed, male and female. Previously reported minimal force tolerances for the frontal, temporoparietal, and zygo-

Deceleration tolerances; Impact sleds; Head restraints; Motion pictures; Injury severity; Human body kinematics; Extension; Injury research

HS-012 385 Fld. 1/2; 4/7; 3/2

NONLINEAR VISCOELASTIC MODEL FOR HEAD IMPACT INJURY HAZARD

by R. C. Haut; C. W. Gadd; R. G. Maden

General Motors Corp., G06600

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p149-59

1972 13refs

Report no. SAE-720963

shows that ejected occupants usually sustain more severe injury than contained occupants. Several conclusions are presented as to automobile structures in relation to injury.

Search terms: Rollover accidents; Injuries by accident type; Injury severity; Injuries by body area; Accident analysis; Restraint system usage; Ejection; Fatalities; Secondary collisions; Injury causes; Accident causes; Roof failures; Deceleration; Accident case reports; Accident severity

HS-012 389 Fld. 1/2; 5/14

INJURY FREQUENCY AND HEAD RESTRAINT EFFECTIVENESS IN REAR-END IMPACT ACCIDENTS

by J. D. States; J. C. Balcerak; J. S. Williams; A. T. Morris; W. Babcock; R. Polvino; P. Riger; R. E. Dawley

Rochester Univ., R15000

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p228-57

1972 92refs

Report No. SAE-720967

All of the rear end impact accidents occurring in the city of Rochester, New York, in a three-month period were surveyed by tabulation of the police accident reports. Analysis of the data indicated that 73% of adjustable head restraints are left in the down position and not adjusted by users; head restraints reduce the frequency of whiplash injury by 14%; fixed head restraints appear to be more effective than adjustable head restraints; women sustained whiplash injury more frequently than men; head restraints decreased whiplash injury frequency (WIF) for women more than for men; center and rear seat occupants have an unexpectedly low WIF; the overall WIF was 38%, 37% for head restraint-equipped seats and 43% for unequipped

driver and right front seats; and the actual number of rear end impacts meeting the study criteria, a total of 691, was approximately half that retrieved by a computer program from an accident report data bank. An extensive review of the literature related to whiplash injury and head restraint design and effectiveness is also presented.

Search terms: Rear end collisions; Rochester (N. Y.); Whiplash injuries; Head restraint usage; Restraint system effectiveness; Head restraint design; Reviews; Injuries by accident type; Injury rates; Cervical spine injuries; Head restraint caused injuries; Human body kinematics; Injuries by sex; Data acquisition; Injury research; Questionnaires

HS-012 391 Fld. 1/2

EFFECT OF LONG-DURATION IMPACT ON HEAD

by V. R. Hodgson; L. M. Thomas

Wayne State Univ., W09600

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p292-5

1972 6refs

Report no. SAE-720956

Impacts have been analyzed in terms of degree of injury, head injury criterion (HIC), and average acceleration as a function of time for frontal impacts against the following surfaces: rigid flat surface—fractured cadaver skull; astro-turf—head drop of football-helmeted cadaver; windshield penetrating impact of a dummy; and airbag—dynamic test by human volunteers. It is concluded that the linear acceleration/time concussion tolerance curve may not exist and that only impacts against relatively stiff surfaces producing impulses with short rise times can be critical. The authors hypothesize that if a head impact does not contain a critical HIC interval of less

than 0.015 s, it should be considered safe as far as cerebral concussion is concerned.

Search terms: Head impact tolerances; Head injuries; Cadavers in testing; Injury research; Head acceleration tolerances; Injury severity; Brain concussion; Acceleration onset rate; Air bag caused injuries; Windshield impact tests; Drop tests; Acceleration pulses; Test volunteers; Dummies

HS-012 392 Fld. 1/2

PATHOPHYSIOLOGIC RESPONSES TO ROTATIONAL AND TRANSLATIONAL ACCELERATIONS OF THE HEAD

by T. A. Gennarelli; L. E. Thibault; A. K. Ommaya

National Institutes of Health, N21800; Georgetown Univ., G15900

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p296-308

1972 2refs

Report no. SAE-720970

Acceleration-time data in 25 squirrel monkeys subjected to controlled sagittal plane head motions are presented. In 12 of the 25 animals subjected to pure translation of the head at peak positive g levels ranging between 665-1230 g, cerebral concussion was not obtainable. In contrast, 13 of the animals subjected to head rotations at peak positive tangential g levels ranging between 348-1,025 g were all concussed. Visible brain lesions were noted in both translated and rotated groups but with a greater frequency and severity after rotation. An analysis of the lesions produced in both groups is presented, along with preliminary data on the use of the evoked somatosensory response as an objective, quantifiable index for the onset and severity of brain damage in head injury.

1/2 Injuries (Cont'd.)

HS-012 392 (Cont'd.)

Search terms: Head acceleration tolerances; Head movement; Brain injuries; Acceleration response; Injury research; Cerebral hemorrhage; Animal acceleration tolerances; Brain stem injuries; Brain concussion; Monkeys; Animal experiments

HS-012 396 Fld. 1/2; 5/14

IMPACT TOLERANCE AND RESULTING INJURY PATTERNS IN THE BABOON: AIR FORCE SHOULDER HARNESS-LAP BELT RESTRAINT

by T. D. Clarke; D. C. Smedley; W. H. Muzzy; C. D. Gragg; R. E. Schmidt; E. M. Trout

Aerospace Medical Res. Lab. (6570th), A10300

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p365-411

1972 25refs

Report no. SAE-720974; AMRL-TR-72-74

The tolerance to abrupt linear deceleration and impact trauma patterns resulting from the use of the Air Force shoulder harness-lap belt restraint were investigated. Eighty-nine deceleration tests were performed with 37 adult male baboons. Peak sled decelerations ranged from 6.5-134 g. The stopping distance varied from 0.5-3.5 ft. at 6 in. increments. The results imply that for the exposure range of these tests, impact lethality is dependent upon the magnitude of peak sled deceleration, irrespective of the pulse duration, sled velocity, or stopping distance. At all stopping distances, the primary cause of death was lower brainstem or cervical spinal cord trauma. The pelvic, abdominal, and thoracic injury patterns were significantly different at the various stopping distances.

Search terms: Baboons; Deceleration tests; Stopping distance; Deceleration caused injuries; Restraint system tests; Animal experiments; Animal deceleration tolerances; Shoulder harness caused injuries; Seat belt caused injuries; Injury research; Three point restraint systems; Impact sleds; Impact velocity; Fatality causes

HS-012 412 Fld. 1/2; 1/3

NATURAL DEATH AT THE WHEEL

by I. West; G. L. Nielsen; J. R. Ryan; A. E. Gilmore

California Dept. of Public Health, C03600; Sacramento County Office of the Coroner, Calif., S00300; Department of Transp., D17400

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p67-71

1971 2refs

Abridged version of an article in *Journal of the American Medical Association* v204 p266-72 (Jul 1968).

Of the 1,026 drivers studied, 155 died at the wheel of natural causes. These drivers had a mean age of 60 years, and 96% were men. The youngest was 27 and the oldest 79 years of age. The natural death accidents were predominantly daytime occurrences, and three-fourths of them took place between 6 a.m. and 8 p.m. The less densely populated areas contributed proportionately more accidents than did the metropolitan areas. It is recommended that the number of drivers who die of natural causes should be recorded as a special category in traffic accident statistics; physicians should advise all patients who are drivers and who have had episodes from coronary artery disease about their fitness to drive; applicants for drivers' licenses and renewal of licenses could be asked to note on their applications whether or

not they have heart disease; and a special medical examination should be required of drivers over 40 each time they renew their licenses, to identify those with latent coronary disease.

Search terms: Natural deaths; Driver fatalities; Single vehicle accidents; Male drivers; Adult drivers; Driver physical fitness; Time of accidents; Heart diseases; Rural accidents; California; Age factor in accidents; Medical factor caused accidents; Blood alcohol levels; Physicians and highway safety; Driver physical examinations

HS-012 413 Fld. 1/2; 1/3

A SURVEY OF SUDDEN, UNEXPECTED DEATHS IN AUTOMOBILE DRIVERS

by D. J. DiMaio

New York City Office of the Chief Medical Examiner, N48600

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p75-80

1971

Heart disease, primarily occlusive coronary arteriosclerosis and its sequelae, was the most frequent cause of death among 47 drivers who died suddenly of natural causes while driving. Statistics show that 65.9% of the men and 4.3% of the women who died were involved in minor accidents, producing little if any damage to property or objects struck, and minor injuries to drivers or passengers. Alcohol, barbiturates, tranquilizers, antihistamines, amphetamines, and carbon monoxide were not contributory to the accidents that occurred.

Search terms: Natural deaths; Driver fatalities; Heart diseases; Arteriosclerosis; Driver age; Driver sex; Accidents by body types; Fatalities by age; Medical factor caused accidents; Driver

physical fitness; Fatalities by sex;
Driver occupation; Aortic rupture

HS-012 426 Fld. 1/2

A SUMMARY OF ACIR FINDINGS ON CAUSES OF INJURY AND EFFECTIVENESS OF COUNTERMEASURES

by J. W. Garrett

Cornell Aeronautical Lab., Inc., Automobile Crash Injury Res., C67800

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p222-8

1971 14refs

Contract FH-11-7098; CAL-6901-G129

Supported in part by the Automobile Manufacturers Assoc.

Data gathering methods of the Automotive Crash Injury Research program are surveyed. Statistics are given for rural accidents on frequency of door opening on collision, passenger ejection, risk of injury related to ejection or non-ejection, and causes and degree of injuries.

Search terms: Ejection caused injuries; Seat belt effectiveness; Door latches; Injury causes; Fatality causes; Rural accidents; Injury risks; Injury severity; Occupant protection

HS-012 429 Fld. 1/2; 4/5

THE ACQUISITION AND APPLICATION OF INJURY AND CERTAIN OTHER MORBIDITY DATA

by B. G. King

Environmental Control Administration, E17200

Published in HS-012 408, *Triennial Congress on Medical and Related As-*

pects of Motor Vehicle Accidents (3rd) Proceedings, Ann Arbor, 1971, p259-66

1971 4refs

There are no established means at this time for direct, professional determination of the essential morbidity data for the community, state, and nation. One approach and the initial activities in seeking to achieve the full potential benefits of emergency medical facilities as sources for representative sampling of injury and noninjury medical conditions that may be associated with environmental stresses are described. Some of the requirements for success in data acquisition from a medical facility are: the program must be accomplished without changing the standard operating procedures of the hospital; additional personnel are required to transcribe information from the hospital's patient record sheets to injury-morbidity data record forms; and the physician with the principal responsibility and authority for professional direction of emergency medical activities must be aware of the potential direct benefit of the procedures and data for the medical facility.

Search terms: Data acquisition; Medical records; Hospital records; Injury research

HS-012 430 Fld. 1/2

1000 CONSECUTIVE MAJOR FACIAL INJURIES FROM AUTO ACCIDENTS

by R. C. Schultz

Illinois Univ., I14400

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p295-7

1971

The common mechanism of soft tissue injury occurred not when the victim was thrown through the windshield, but at

the time of the second crash, when the forward momentum of the car had stopped and the victim was thrown back down onto the seat, sustaining a tearing injury of the forehead, brow, and eyelids as he returned past the lower edge of the broken windshield. As a result of the new improved windshield construction with a plastic interlayer and tempered inner pane, the pattern of soft tissue injuries is beginning to change to numerous small superficial lacerations and triangular avulsion flaps. These demand less major surgical repair initially, but frequently require subsequent surgical revision. A different pattern of deceleration may cause the victim to strike his face against the dashboard often fracturing the bones of the midface.

Search terms: Facial injuries; Windshield caused injuries; Safety glass; Instrument panel caused injuries

1/3 Investigation

HS-012 390 Fld. 1/3; 1/2; 5/14

CAR CRASH COLLISION TYPES AND PASSENGER INJURIES IN DEPENDENCY UPON CAR CONSTRUCTION (FIELD STUDIES OF THE GERMAN AUTOMOBILE INSURANCE COMPANIES)

by K. Langwieder

HUK-Verband (West Germany), H20950

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p258-91

1972 6refs

Report no. SAE-720968

This paper analyzes 10,271 car crashes with passenger injuries. It is shown what types of impact are found in real-life collisions and at what speeds they occur. Factors influencing accident severity are discussed. Car crashes occur mostly at a collision speed below 60 km/h. Frequently, serious injuries and fatalities occur in cases with only moderately

1/3 Investigation (Cont'd.)

HS-012 390 (Cont'd.)

severe car damage. Fractures of the skull base, cervical spine, sternum, pelvis, and lower extremities, as well as eye injuries are frequent. Influences of the car construction in generating these kinds of injuries are discussed. Effectiveness and possibilities of safety measures, such as safety belts, head restraints, and airbags, were studied with the aid of real-life collisions. It was concluded that safety belts today offer the best protection.

Search terms: Accident types; Restraint system effectiveness; Damage severity; Impact angle; Injuries by seat occupation; Injury severity; Seat belt effectiveness; Injury statistics; Germany; Accident report forms; Front end collisions; Rear end collisions; Intersection collisions; Automated accident records; Injury risks; Injury causes; Accident factors; Fatality rates; Injuries by accident type; Impact velocity; Injuries by body area; Accident investigation; Injury prediction from vehicle damage

HS-012 399 Fld. 1/3; 5/22; 1/2

THE INCIDENCE OF BURST TYRES PRIOR TO INJURY ACCIDENTS ON M1 AND M4 MOTORWAYS

by M. J. Godley

Transport and Road Res. Lab. (England). T33900

1972 13p 6refs
Report no. TRRL-LR-498

This investigation assessed the frequency of burst tires immediately prior to accidents on 152 km of highways from 1968 to 1970. Information available from special police reports was used to study the occurrence of burst tires for different categories of vehicle and the variability of this factor with different roads. Of the 1,910 personal injury acci-

dents reported, 16% were preceded by one of the vehicles involved sustaining a burst tire. Although the numbers of burst tires were greatest for cars, the relative frequency for any type of vehicle was highest for motorcycles and motor scooters; 36% of all two wheeled vehicles incurring a burst tire prior to accident involvement. For private cars and light goods vehicles combined, the figure was 10%, and for heavy goods vehicles 3%. On M1, 18% of personal injury accidents were preceded by a burst tire while for M4 the figure was 13%.

Search terms: Tire failure caused accidents; Accident severity; Injury rates; Injury statistics; England; Motorcycle accidents; Motor scooter accidents; Truck accidents; Accident analysis; Accident rates; Accident statistics; Automobile accidents

HS-012 403 Fld. 1/3; 3/4; 4/7; 2/9

ACCIDENTS, OVERTAKING AND SPEED CONTROL

by E. Hauer

Published in *Accident Analysis and Prevention* v3 n1 p1-13 (Jul 1971)

1971 6refs

Accident involvement rates are observed to be higher at slow and fast travel speeds than for intermediate velocities. The hypothesis is advanced that accident involvements are related to overtakings. It is shown that the total number of overtakings varies with speed in a manner which is similar to that of the accident involvement rate. Implications of the rate of overtaking on the speed selection by the driver are explored. The effect of various collective speed control strategies on the total amount of overtaking is investigated. The analysis, interpretation, and conclusions are related only to rural roads between intersections. Minimum speed limits are more

effective in reducing overtaking than maximum speed limits.

Search terms: Accident rates; Overtaking; Speed control; Speed differential; Day vs night speeds; Rural highways; Low speed caused accidents; High speed caused accidents; Speed patterns; Accident causes; Speed limit effectiveness; Mathematical analysis; Low speed drivers; Minimum speed limits; Driver behavior

HS-012 404 Fld. 1/3; 4/7; 4/3

TOWARDS A METHODOLOGY OF TRAFFIC SAFETY MEASUREMENT AND PROGRAM EVALUATION

by A. Katz

Published in *Accident Analysis and Prevention* v3 n1 p15-43 (Jul 1971)

1971 49refs

By examination of empirical examples an attempt is made to identify measurement requirements common to the many countermeasure techniques employed in the traffic safety field. The integrating mechanism for the analysis of the various examples is a measurement typology which relates countermeasure programs to their target populations, program inputs (cost), program outputs (injury and damage reduction), accident time phase, and the level of program and measurement aggregation desired. Two simplified models are presented: a multiplicative model of activity and danger; and a multifactor model of road, vehicle, driver, and environmental elements. Combined with emphasis on improved measurement models is a parallel emphasis on systems analysis where complex countermeasures are being evaluated.

Search terms: Accident research; Program evaluation; Research methods; Highway safety programs; Safety program effectiveness; Accident factors;

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HS-012 405

DIGIT PORTED RESEAR

by S. P. Bak

Published in
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1971

Sponsored
Safety and
Foundation

This study
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Benefit cost analysis; Injury prevention; Accident prevention; Precrash phase; Crash phase; Postcrash phase; Systems analysis; Mathematical models; Seat belt effectiveness; Driver behavior research; Accident rates; Flow charts; Accident risks

HS-012 406 Fld. 1/3; 1/1

DIGIT PREFERENCE IN REPORTED TIME OF COLLISION. RESEARCH NOTE

by S. P. Baker

Published in *Accident Analysis and Prevention* v3 n1 p77-80 (Jul 1971)

1971

Sponsored by Insurance Inst. for Hwy. Safety and the Maryland Medical Legal Foundation, Inc.

This study of Maryland accidents was undertaken to determine the extent to which digit preference is evident in recorded time of collision, and the possible usefulness of the phenomenon in assessing the degree to which times are approximated rather than known. Digit preference was also analysed in relation to hour of the day. Other variables of interest included severity of crash, time of notification, and elapsed time from notification to arrival of police at the scene. Minutes after the hour were recorded as a multiple of five in 77% of all cases. Collisions were recorded as having occurred exactly on a quarter-hour in 42% of all cases. In general, nighttime crashes showed more digit preference than daytime crashes. The evidence suggests that rounding to 15 min. intervals in time of crash is due not to lack of interest in precision but rather to lack of knowledge of exactly when a crash occurred. The study pertains to determining the delay in emergency medical care.

Search terms: Time of accidents; Time of day; Accident severity; Accident

reports; Maryland; Accident studies; Day vs night accidents; Emergency medical services

HS-012 408 Fld. 1/3; 1/2; 3/4; 3/1; 1/5

TRIENNIAL CONGRESS ON MEDICAL AND RELATED ASPECTS OF MOTOR VEHICLE ACCIDENTS (3RD) PROCEEDINGS, NEW YORK, MAY 29-JUNE 4, 1969

International Assoc. for Accident and Traf. Medicine (Sweden), I37200

1971 321p refs

Includes HS-012 409-HS-012 432.

Papers were presented on the following topics: the magnitude of the problem of motor vehicle injuries and deaths; personality and psychological factors among drivers; special problems of various age groups; physiological factors; natural deaths as causes of motor vehicle accidents; death caused by suicide; accidents with less than four wheeled vehicles; accidents to pedestrians; alcohol and motor vehicle accidents; relationship of other drugs or toxic substances to motor vehicle accidents; injury patterns and motor vehicle design; emergency medical services; types of motor vehicle accidents and their injuries; and the role of the physician in the problem of motor vehicle accidents.

Search terms: Accident investigation; Driver performance; Accident causes; Injury causes; Accident statistics; Fatality causes; Driver personality; Driver age; Age factor in accidents; Natural deaths; Suicide by vehicle; Pedestrian accidents; Motorcycle accidents; Bicycle accidents; Driver intoxication; Drinking drivers; Accident analysis; Emergency medical services; Accident types; Injury research; Physicians and highway safety; Drug effects; Driver physical fitness

HS-012 414 Fld. 1/3

THE SUICIDE CRASH

by J. F. Edland

Monroe County Office of the Medical Examiner, N. Y., M56050

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p81-4

1971 5refs

The method of accident investigation in Monroe County, New York, is briefly described. Procedures for certifying vehicular suicide or accidental death are discussed. Mention is made of the legal ramifications of certified suicide, and the difficulty of such certification since judgement must be based on opinion with very little physical evidence available in most cases.

Search terms: Suicide by vehicle; Deliberate accidents; Accident investigation; New York (State)

HS-012 415 Fld. 1/3; 1/2; 3/3; 3/11

THE OTHER ROAD USERS: THE PEDESTRIAN, CYCLIST AND MOTORCYCLIST

by A. J. McLean

Harvard School of Public Health, H04800

Published HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p85-7

1971

The pedestrian, cyclist, and motorcyclist were involved in 44% of the accidents studied, but accounted for 88% of all fatalities. Their injuries were caused by a

1/3 Investigation (Cont'd.)

HS-012 415 (Cont'd.)

series of impacts with the striking vehicle and the road surface. The height and shape of the bumper has a great influence on the location and severity of a pedestrian's leg injuries. The overall shape of the front half of the car determines the kinematics of the pedestrian impact. The cyclist is generally less likely to receive severe leg injuries than is the pedestrian. Transverse impacts may be initially on the bicycle rather than directly on the rider. In this case he is likely to be struck by the front corner of the roof of the car as his cycle is swept from under him. He is exposed to injury in a manner similar to the motorcyclist whose machine is struck from the side.

Search terms: Pedestrian accidents; Bicycle accidents; Bicycle rider injuries; Motorcycle accidents; Motorcycle operator injuries; Injury causes

HS-012 416 Fld. 1/3; 3/11; 4/7

COMPUTER SIMULATION OF PEDESTRIAN ACCIDENTS

by D. J. Segal

Cornell Aeronautical Lab., Inc., C67200

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p97-121

1971 2refs
Contract FH-11-6955

The simulated pedestrian corresponds mathematically to an articulated assembly of three rigid bodies which are generally used to represent the leg mass, torso-arm mass, and head-neck mass. In two dimensions, the pedestrian has a total of five degrees of freedom. The three body segments are connected by

two pivotal joints which include both an approximation of muscular restraint and motion limiting stops to inhibit bending beyond preset typical ranges of relative angular movement. Parameters for this model include influence of vehicle speed, vehicle stiffness, shape, motion, and pedestrian size. Results obtained from the model indicate its usefulness in attempting to understand some fundamental relationships involved in pedestrian collisions.

Search terms: Pedestrian accidents; Computerized simulation; Adult pedestrians; Children; Pedestrian vehicle interface; Vehicle pedestrian collisions; Human body kinematics; Impact velocity; Mathematical models; Vehicle design; Human body simulation; Stiffness; Accident research

HS-012 417 Fld. 1/3; 3/11

PEDESTRIAN ACCIDENTS IN NEW YORK CITY

by E. M. Gross

New York City Office of Chief Medical Examiner, N48600

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p121-6

1971

In the borough of Manhattan, 151 accidents were listed as pedestrian fatalities, resulting from vehicular accidents in 1968. Statistics are given on age, sex, location, and vehicle type. Fatalities due to unusual circumstances are listed, and types of injuries are given.

Search terms: Pedestrian fatalities; Pedestrian age; Pedestrian sex; Time of accidents; Vehicle pedestrian collisions; Alcohol usage; Racial factors; New York (City); Pedestrian injuries; Accident location

HS-012 419 Fld. 1/3; 3/1

CORRELATION BETWEEN THE BLOOD ALCOHOL LEVEL AND FATAL TRAFFIC ACCIDENTS IN PUERTO RICO

by S. Kaye

Puerto Rico Univ., P40850

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p136-41

1971 18refs

Sponsored by Puerto Rico Hwy. Safety Commission.

Statistics are given for fatal driver and pedestrian accidents during 1968. The trend toward higher fatalities and more drinking drivers is noted. Of 545 total traffic deaths, 304 cases were studied, and blood alcohol levels were determined in only 206 of these. Sixty of 135 pedestrians, 10 of 29 passengers, and 25 of 32 drivers were positive for alcohol.

Search terms: Blood alcohol levels; Drinking drivers; Driver intoxication; Pedestrian fatalities; Driver fatalities; Fatalities by sex; Pedestrian intoxication; Puerto Rico; Drinking pedestrians

HS-012 424 Fld. 1/3

ANALYSIS OF COLLISION ACCIDENTS IN SWEDEN

by S. A. Englund

Sweden National Road Safety Board, S56100

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p183-6

1971

The study concentrated on 263 collisions occurring during October 1966 and October 1967, before and after Sweden had changed to right side of the road driving. Statistics are given for situations in which there was a relapse into left of the road rule, fatalities, hospitalization, and injuries. Brief mention is made of seat belt usage and effectiveness.

Search terms: Left hand rule of the road; Right hand rule of the road; Centerline crossover collisions; Wrong way driving; Accident route familiarity; Driver error caused accidents; Seat belt usage; Sweden; Fatalities; Injuries

HS-012 425 Fld. 1/3; 1/2

THE INJURY RISK OF ROLLOVER ACCIDENTS IN RACING AND HIGHWAY DRIVING

by J. D. States; R. Sweetland

Rochester Univ., R15000

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p203-13

1971 6refs

The use of restraint systems to hold occupants inside vehicles and in place during rollover accidents is the single most effective means of protection. Prevention of roof collapse and preservation of the occupant space are essential for optimal function of restraint systems. Serious injury occurred only when there was collapse of the occupant space or when the occupants were ejected from their vehicles. Head injuries are common among unrestrained occupants. In spite of their lack of helmets, serious head injuries did not occur among restrained occupants. Upper extremity injuries were frequent in all groups and were caused by flailing of the upper extremities.

Search terms: Rollover accidents; Racing accidents; Roof failures; Head

injuries; Restraint system effectiveness; Accident case reports; Roll bars; Helmets; Injury risks; Arm injuries; Traffic accidents

HS-012 432 Fld. 1/3; 1/2; 1/5

THE EPIDEMIOLOGY OF MOTOR VEHICLE ACCIDENTS IN THE INDUSTRIALIZED COUNTRIES OF THE WORLD

by R. A. McFarland

Harvard School of Public Health, H04800

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor 1971, p1-16

1971 19refs

A review of the available statistics from 48 countries indicates a total of more than 169,000 deaths from motor vehicles occurred in these countries in 1966. While in general casualties are highest among the occupants of motor cars for certain countries, casualties among motorcycle and pedal cycle riders are a major problem. An understanding of the role of disease and illness in motor vehicle accidents is necessary and more reliable criteria for disqualification are needed. The design of highways is inadequate to eliminate accidents resulting from human error, and the influence of poor lighting appears to be of great importance. Studies of the mechanisms of injury in vehicular crashes are being used to improve the safety design of vehicle interiors.

Search terms: Accident research; Epidemiology; International factors; Fatality rates; Injury rates; Pedestrian fatalities; Drinking drivers; Driver intoxication; Driver personality; Accident rates; Driver physical fitness; Driver age; Motorcycle operator injuries; Motorcycle operator fatalities; Life years lost in accidents; Accident

factors; Blood alcohol levels; Injury causes; Driver characteristics; Occupant protection; Motor scooter accidents; Pedestrian injuries

HS-012 439 Fld. 1/3; 3/4

ANALYSIS OF NEAR-ACCIDENTS AND ACCIDENTS ON THE HIGHWAY

by J. D. Zuercher; E. J. Sass; J. M. Weiss

Published in *Behavioral Research in Highway Safety* v2 n2 p98-106 (Fall 1971)

1971 8refs

The cause of accidents on the highway can be attributed to three main factors: the highway, vehicle, and driver. Using the Critical Incident Technique, observers were asked to clearly recall an accident or near-accident and to judge the elements leading up to the incident. Two samples were polled: college students and taxicab drivers. The driver was blamed for the accident or near-accident more often than either the highway condition or the vehicle. Inattention and excessive speed were the two most commonly mentioned factors, and driver skill was most frequently listed as the element responsible for either avoidance of an accident or reduction of its seriousness. The driver, including his attention, judgment, and skill, was seen as the important ingredient for safety on the highways.

Search terms: Accident factors; Accident analysis; Accident causes; Accident avoidance; Driver skills; Attention lapses; High speed; Judgment; Driver interviews; Careless driving; Drinking drivers; Driver behavior; Taxicab drivers; College students; Questionnaires; Accident responsibility; Driver experience; Driver performance; Driver error caused accidents; Driver vehicle road interfaces; Accident severity; Young adult drivers

1/5 Statistical data

HS-012 409 Fld. 1/5; 1/2

HOSPITAL STATISTICS ON ROAD TRAFFIC ACCIDENTS

by J. Thorson; J. Sande

Sweden Statens Trafiksakerhetsrad, S58200; Sweden Central Bureau of Statistics, S55500

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p20-4

1971

In a region containing one-sixth of the total population in Sweden the official statistics on road traffic accidents based upon police reported accidents only include 28% of seriously injured persons. Another 21% were known to the police but had been wrongly reported in the statistics as slightly injured. Persons injured by car accidents or those requiring more than two weeks of hospital stay comprise a greater proportion of the official statistics than of the whole material. Thus persons requiring hospitalization for one or two days, pedal cyclists, and children, were underrepresented. Persons injured in transport accidents that did not happen on roads were probably included in the hospital statistics but not in the official statistics.

Search terms: Accident statistics; Accident reports; Hospital records; Police reports; Driver injuries; Motorcycle operator injuries; Bicycle rider injuries; Sweden; Injury statistics; Injury classification; Hospitalization reporting; Injuries by age; Injuries by sex; Injury severity

2/0 HIGHWAY SAFETY

2/7 Meteorological Conditions

HS-012 401 Fld. 2/7; 2/4

HIGHWAY NOISE. A DESIGN GUIDE FOR HIGHWAY ENGINEERS

by C. G. Gordon; W. J. Galloway; B. A. Kugler; D. L. Nelson

Bolt, Beranek and Newman, Inc., B18000

1971 89p 33refs
Report no. NCHRP-117

Sponsored by the American Assoc. of State Hwy. Officials in cooperation with the Federal Hwy. Admin.

In order to control traffic noise, a design guide is needed that will allow highway engineers to consider this problem in the design of future highways. The technical considerations used in calculation procedures and the design criteria given in the design guide portion of this report are summarized. Different analytical and experimentally derived models of traffic noise are discussed and compared, and the model used in the design guide is described. The sources of information and technical approaches used in determining the noise level adjustments for finite element length, acoustical barriers, elevating or depressing the roadway, gradients and different road surface conditions, and the presence of intervening buildings or foliage between the observer and the noise source are given. Several approaches to the selection of criteria for traffic noise level determination are described and compared. The text of an illustrative recording of traffic noise is included as Appendix B.

Search terms: Highway design; Highway construction; Noise control; Acoustic measurement; Traffic noise; Traffic noise models; Vehicle noise; Sound intensity; Traffic density; Highway characteristics; Acoustic barriers; Road grade separation; Noise tolerances; Landscaping

AVAILABILITY: HRB \$4.60

2/9 Traffic Control

HS-012 407 Fld. 2/9; 2/6; 2/4

TRAFFIC REVIEWS FOR OPERATIONAL EFFICIENCY

Federal Hwy. Administration, F05400

1973 35p 17refs

A traffic operations review is an organized and continuing program of repetitive field observations and inspections of highway facilities and traffic in order to detect inefficient and erratic traffic operations which may be caused by deficiencies in geometric design features, traffic control devices, or other related factors. The overall objective of an operational review is to attain maximum efficiency from the facility and to retain this level of operational performance on a continuing basis. Procedures for organizing a traffic operations review are discussed. Highway elements needing review include pavement surface and shoulders, medians, interchanges, intersections. Traffic control devices and traffic regulations also need review. Personnel, time, and frequency needed are discussed.

Search terms: Inspection procedures; Traffic management; Highway improvements; Highway management; Highway design; Road shoulders; Road surfaces; Medians; Interchanges; Intersections; Traffic control devices; Traffic law enforcement; Manpower utilization; Inspection frequency;

AVAILABILITY: GPO

3/0 HUMAN FACTORS

3/1 Alcohol

HS-012 418 Fld. 3/1; 1/3

PSYCHOLOGICAL-BIOGRAPHICAL CORRELATES OF PROBLEM DRIVERS AND DRINKING DRIVERS

by M. W. Perrine

Vermont Univ., V04200

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p129-33

1971

Contract FH-11-6609; FH-11-6899

The experimental plan specified seven different driver samples: a fatal crash driver, a serious injury crash driver, a driver cited for driving while intoxicated, a driver cited for another moving violation, a driver with a clear record, a driver stopped at a fatal crash site roadblock, and one stopped at a serious injury crash site. Results of the study showed 68% of drivers who died within 6 hours after highway crashes had alcohol in their blood, and of these, those 25 or older were likely to have fatty changes of the liver. Among roadblock control group drivers, 18% said they did not drink. Of those who said they did drink, 28% stated they never combine drinking and driving. The greater the usual alcohol consumption among roadblock drivers, the greater the likelihood that they had alcohol in their blood when stopped. A consistent relationship was found among drivers stopped at roadblocks between presence of alcohol, reported drinking habits, and poor driving record in the previous five years. A relation also was found between marital and job instability and poor driving record.

Search terms: Drinking drivers; Driver intoxication; Alcohol usage; Driver fatalities; Blood alcohol levels; Problem drivers; Vermont; Driver personality; Driver records

HS-012 420 Fld. 3/1; 3/4

THE INTOXICATED MOTOR VEHICLE OPERATOR

by A. P. Schlein; J. M. Janes

Minnesota Univ., M48300; Mayo Clinic, M16300

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p143-7

1971 5refs

A method of collecting clinical and legal information in highway intoxication cases is outlined. Tabulations of a sample of arrests are given by age, marital status, occupation, blood alcohol, total arrests, traffic arrests, and times license was revoked. Police reports indicate that none of 35 apprehended drivers were using seat belts.

Search terms: Drinking drivers; Driver intoxication; Blood alcohol levels; Traffic law violators; Arrest procedures; Driver occupation; Driver attitudes; Seat belt usage; Driver license revocation; Marital status; Driver age; Minnesota; Driver records

HS-012 421 Fld. 3/1

ALCOHOL, ALCOHOLISM, ALCOHOLEMIA AND DRIVERS

by A. Maglajlic

Osijek General Hosp. (Yugoslavia), O20600

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p149-53

1971 11refs

The method used in a Yugoslavian hospital for examining and classifying levels of intoxication is described. It was found that clinical impressions always indicate a lower degree of alcoholization than was revealed by the exact analysis of blood alcohol concentration. Further tests will attempt to standardize the examination criteria.

Search terms: Drinking drivers; Driver intoxication; Drinking driver evidence; Blood alcohol levels; Yugoslavia; Alcoholism; Alcohol effects

3/2 Anthropomorphic Data

HS-012 380 Fld. 3/2; 4/7

IMPROVED NECK SIMULATION FOR ANTHROPOMETRIC DUMMIES

by J. W. Melvin; J. H. McElhaney; V. L. Roberts

Michigan Univ. Hwy. Safety Res. Inst., M40800

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p45-60

1972 16refs

Report no. SAE-720958

Sponsored by the Motor Vehicle Manufacturers Assoc.

The development of an improved neck simulation that can be adapted to current anthropometric dummies is described. The primary goal of the neck design is to provide a reasonable simulation of human motion during impact while maintaining a simple, rugged structure. Development tests on neck simulations were carried out using a small impact sled. Tests on the final prototype simulation were also performed with a dummy on a large impact sled. Both accelerometers and high-speed movies were used for performance evaluation. A mathematical model of the cervical spine was developed for the purpose of comparing the neck simulation responses to the results obtained from the human volunteer sled tests. When tested with acceleration inputs similar to the inputs experienced by human volunteers in flexion and extension, the neck simulation has been shown to produce realistic motions of the head in the sagittal plane.

Search terms: Human body simulation; Anthropometric dummies; Neck; Neck motion range; Human body kinematics; Impact sleds; Flexion; Mathematical models; Cervical spine; Test volunteers; Head motion range; Acceleration response; Viscoelasticity; Extension

HS-012 381 Fld. 3/2

MECHANICAL NECKS WITH HUMANLIKE RESPONSES

by C. C. Culver, R. F. Neathery; H. J. Mertz

General Motors Corp.

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p61-75

1972 4refs
Report no. SAE-720959

A neck skeletal structure has been developed for dummies used in crash testing. The structure has five articulative joints. The top joint simulates the occipital condyles and allows only nodding action. The remaining four joints are split balls that allow rotation about any axis and limited axial motion. The neck depends upon annular resistive elements around the ball joints and cushions in the top joint to resist bending. Extension characteristics based on biomechanical data have been satisfied by elements made from polyvinyl chloride and by elements made from polyurethane. Flexion requirements have been met by elements made of the same polyurethane, although further testing is required. No set of elements has been developed that simultaneously satisfied extension and flexion requirements. This study has demonstrated the feasibility of satisfying the Mertz-Patrick response characteristics relating to specific laboratory experiments designed to determine human neck behavior.

Search terms: Biokinematic models; Human body simulation; Viscoelasticity; Biomechanics; Flexion; Anthropomorphic dummies; Neck; Ball joints; Neck motion range; Dynamic loads; Polyvinyl chloride; Polyurethane foams; Extension

HS-012 383 Fld. 3/2; 4/7; 1/2

DEVELOPMENT AND VALIDATION OF A COMPUTER SIMULATION OF A CRASH VICTIM IN THREE DIMENSIONS

by J. A. Bartz

Cornell Aeronautical Lab., Inc., C67200

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p105-27

1972 7refs
Report no. SAE-720961

Sponsored by the National Hwy. Traf. Safety Administration and the Motor Vehicle Manufacturers Assoc.

The digital computer simulation includes a body dynamics model of 40° of freedom and a contact model that generates forces from contact with vehicle surfaces, between body segments of the crash victim, and restraint forces from belts and inflatable restraints. The validity of the computer simulation was determined from comparisons of predicted responses with those measured in various experiments, including static bench tests, pendulum tests, impact sled tests, and a full-scale automobile crash test. Inputs to the computer program were based on detailed measurements of dummy characteristics and measured properties of the contact surfaces and restraints. The generally good agreement between the simulation and experimental results, plus the relatively low cost of exercising the model (\$50./computer run), demonstrate that the computer program is a useful engineering tool.

Search terms: Computerized simulation; Mathematical models; Human body simulation; Model tests; Occupant vehicle interface; Occupant modeling; Impact sleds; Pendulum tests; Air bag restraint systems; Anthropomorphic dummies; Vehicle vehicle impact tests; Seat belt loading; Acceleration response; Human body

segment parameters; Injury research; Test equipment; Static tests

HS-012 386 Fld. 3/2; 4/7

MEASUREMENT OF MASS DISTRIBUTION PARAMETERS OF ANATOMICAL SEGMENTS

by E. B. Becker

Naval Aerospace Medical Res. Lab., N31 300

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p160-85

1972 1ref
Report no. SAE-720964

Funded by the Navy Bureau of Medicine and Surgery and the Medical and Dental Div. of the Office of Naval Res.

Procedures to determine the center of mass and the moments of inertia in three dimensions of anatomical segments are presented. These procedures are applied to the human head and head-and-neck. The majority of the procedures involve measurements made on the stereotaxic jig. This jig is composed of a stereotaxic unit set into a tetrahedral frame. The stereotaxic unit is designed to locate and secure the subject within it. The center of mass and the moment of inertia of the subject-jig combination and the empty jig are compared to yield the subject center of mass and moment of inertia. Once the subject has been located within the jig, these mechanical parameters can be transformed to anatomically based coordinates. The results of measurements made on six human heads and three head-and-necks are discussed.

Search terms: Human body center of mass; Human body mass moment of inertia; Human body segment parameters; Head; Neck; Test equipment; Mathematical analysis; Human body center of gravity; Cadaver measurements; Human body segment weight; Computer programs; Equations; Measuring instruments

HS-820 211 Fld. 3/2; 1/3

OCCUPANT MOTION SENSORS: ROTATIONAL ACCELEROMETER DEVELOPMENT. TECHNICAL REPORT

by A. Warner; D. Ofsevit; G. Plank

National Hwy. Traf. Safety Administration, N19900

1972 30p 6refs

Report no. DOT-TSC-NHTSA-72-1

A miniature mouthpiece rotational accelerometer has been developed to measure the angular acceleration of a head during vehicle crash or impact conditions. The device has been tested in the laboratory using a shake table and in the field using dummies and humans. The results of the testing show that while the accelerometer is sensitive to angular acceleration it is also sensitive to linear acceleration, and in practical applications a correction factor for linear accelerations must be applied to the rotational output.

Search terms: Accelerometers; Motion sensors; Angular acceleration; Occupant kinematics; Head forms; Linear acceleration; Anthropometric dummies; Accelerometer tests; Impact sleds; High speed photography; Field tests; Laboratory tests; Rotation; Impact tests; Test volunteers; Calibration

AVAILABILITY: NHTSA

3/4 Driver Behavior

HS-012 410 Fld. 3/4; 1/3

YOUNG DRIVERS: ROAD BEHAVIOR AND MOTIVATIONS

by D. C. Pelz; S. H. Schuman

Michigan Univ., M36600

Published in HS-012 408, *Triennial Congress on Medical and Related As-*

pects of Motor Vehicle Accident (3rd) Proceedings, Ann Arbor, 1971, p44-51

1971

In a sample of suburban male drivers age 16 to 44, accidents and violations were most numerous at age 20. Annual mileage rose steadily from 16 to 20, but even after correcting for exposure (average rate per miles times miles driven last year), the excess of actual over expected crashes and tickets was greatest at age 18 to 20. The excess was highest for young drivers between 18 and 22 with limited mileage; after several years on the road, they were perhaps more confident than their limited experience justified. The onset of adulthood just before 21 was an intersection point of several motivational trends: hostility and thrill-seeking were still high, driving confidence was rising, and life changes and new responsibilities were maximum. This turbulent combination may help to explain the excessive hazard of the 18-20 year old male.

Search terms: Young adult drivers; Adolescent drivers; Male drivers; Adult drivers; Driver attitudes; Driver experience; Driver mileage; Age factor in driving; Traffic law violations; Driver behavior; Driver motivation; Accident risks; Problem drivers

HS-012 423 Fld. 3/4; 3/7

AN EXPLORATORY STUDY OF AUTOMOBILE DRIVING PERFORMANCE UNDER THE INFLUENCE OF LOW LEVELS OF CARBOXYHEMOGLOBIN

by A. M. Ray; T. H. Rockwell

Ohio State Univ., O05400

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p170-82

1971 25refs

Adapted from A. M. Ray's master's thesis.

An experiment was designed to test sensory performance tasks, normal driving tasks, and psychomotor driving performance tasks for three levels of carboxyhemoglobin (COHb). Results showed for the first that the mean and variance of time estimations decreased with increased COHb levels; for the second, with increases in COHb, there were increases in mean and variance of both lap time and cornering velocity for the repetitive cornering task; and the effects of increased levels of COHb on the third set of tasks were decreases in mean velocity but closer to the target velocity for all of the tests except one.

Search terms: Carboxyhemoglobin; Driver performance; Blood carbon monoxide levels; Time perception; Velocity perception; Instrumented vehicles; Proving ground tests

HS-012 434 Fld. 3/4

PROBLEM DEFINITION: THE DRIVING TASK IN THE SYSTEM CONTEXT

by M. Blumenthal

Published in *Behavioral Research in Highway Safety* v2 n1 p43-52 (Spring 1971)

1971 14refs

The contribution of behavioral scientists to the amelioration of the traffic safety problem is judged as limited by fundamental design and management problems of the motor vehicle transportation system. Contrary to industrial safety principles, the vehicle operator is forced to compensate for limitations of the system, resulting in a large and growing social cost, particularly to the inexperienced, the aged, the inebriated, and those with physical or emotional limitations. The inadequate management and design of the system are seen as persisting because of limited understanding of

3/4 Driver Behavior (Cont'd.)**HS-012 434 (Cont'd.)**

the problem and the failure to make explicit and examine the priority given to technological over human values.

Search terms: Driving task analysis; Systems analysis; Driver vehicle road interfaces; Man machine systems; Driver performance; Human factors engineering

HS-012 437 Fld. 3/4; 4/7**CONSISTENCY IN DRIVER RISK TAKING**

by P. M. Hurst

Published in *Behavioral Research in Highway Safety* v2 n2 p73-82 (Fall 1971)

1971 10refs

Grant PHS-AC-66; MH-11294

A driver's choice dilemma among options having different risk levels is considered from the viewpoint of expected cost minimization. A rational rule for such decision making is developed from statistical decision theory, supported by behavioral research on choice determinants. The relevant parameters are considered for potential modification. Comparison suggests that an effort to raise the risk taking threshold is apt to be less successful than one aimed at reducing the inconsistency of choice behavior with a given threshold value. A model for driver risk taking is presented. It applies to any observable choice dimension but requires operational definition of the most relevant stimulus function controlling the choice behavior under study. An example is given in which alternative stimulus functions were evaluated for control of blocked-lane merging behavior.

Search terms: Risk taking; Decision making; Driver behavior research;

Mathematical models; Gap acceptance; Probability theory; Driver behavior; Accident avoidance

HS-012 438 Fld. 3/4; 1/3**AUTOMOBILE ACCIDENTS IN THE YEAR FOLLOWING HIGH SCHOOL: THE PREDICTIVE VALUE OF 377 UNOBTRUSIVE VARIABLES**

by W. Asher; B. Dodson

Published in *Behavioral Research in Highway Safety* v2 n2 p107-22 (Fall 1971)

1971 9refs

Supported by Indiana State Hwy. Commission and Purdue Univ.

Automobile accidents in the year following high school were studied for 377 social-psychological variables on a sample of 7,996. Forty of these variables for the males and 34 for the females were found to be predictors of accidents. These tended to be variables correlated with the socioeconomic-education dimension, high access to cars, and poor acclimatization in school. Driver training courses do not reduce accidents. Students of higher socioeconomic-educational status tend to take driver training.

Search terms: Young adult drivers; Adolescent drivers; Accident risk forecasting; Sociological factors; Psychological factors; Driver education; Male drivers; Female drivers; Correlation analysis; Socioeconomic data; Data analysis; Driver characteristics

HS-012 440 Fld. 3/4**A HIGHWAY SAFETY "SCARE" FILM AND ITS EFFECTS ON PERFORMANCE AND MOOD OF MALES AND FEMALES**

by J. C. LeGarde; M. V. Lubman; J. J. Hartnett

Published in *Behavioral Research in Highway Safety* v2 n2 p83-97 (Fall 1971)

1971 15refs

Based on Master's thesis submitted by the senior author.

An improvised motor task and a mood adjective check list were used to measure motor performance and mood, respectively. Base levels and changes in performance and mood were determined through use of a test-film-retest design, and repeated-measures analysis of variance was used in the data analysis. Subjects experienced increased scores on aggression, activity, depression, and anxiety on the check list as a consequence of viewing the film *Mechanized Death*. Females exhibited a greater increase in mood change and a more rapid recovery to pre-film mood levels than did males, who displayed symptoms for a longer period of time. All subjects had an increase in perceptual-motor test scores; however, it was seen that a decrement in quality occurred, but data were not gathered to support this incidental observation.

Search terms: Motion picture effectiveness; Male drivers; Female drivers; Driver psychological tests; Driver attitude measurement; Stress (Psychology); Fear; Variance analysis; Psychological factors; Driver performance under stress; Anxiety

3/5 Driver Education**HS-012 436 Fld. 3/5; 3/6****DRIVER EDUCATION: A REVIEW AND SUGGESTED INNOVATIONS**

by L. G. Goldstein

National Transp. Safety Board, N30000

Published in *Behavioral Research in Highway Safety* v2 n1 p28-42 (Spring 1971)

1971 71refs

Presented at a NATO conference on driver behavior conducted by the Institute of Road Safety Res., Netherlands, 2-6 Aug. 1971.

This paper presents a brief review of definitions of driver training and education, the rationale and history of formal instruction for drivers, effectiveness of current programs, criticisms of current programs, and special conditions of youthfulness and inexperience as they relate to highway safety. The suggestion is made for development of a diagnostic-remedial approach to driver education, to driver licensing, and to driver improvement programs, such approach to be based on relative probability of accident rather than correlational analysis.

Search terms: Driver education; Driver education evaluation; Driver behavior research; High school driving courses; Driver licensing; Driver tests; Driver improvement schools; Reviews; Driver age; Driver experience; Driver characteristics

3/7 Drugs Other Than Alcohol

HS-012 422 Fld. 3/7

OBJECTIVE MEASUREMENT OF DRUG EFFECTS ON DRIVING

by E. R. Tichauer

New York Univ., N56400

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p155-67

1971

A technique developed to measure objectively the performance of a man-vehicle system under a variety of driver disabilities is reported. While the illustrative biomechanical profiles were obtained under the influence of medications, the study does not permit and was

not intended to arrive at conclusions related to the pharmacological effects of the substances taken by the subjects. This pilot study does not carry the full weight of a properly designed experiment, therefore, the biomechanical profiles presented cannot be accepted as specific for each of the medications cited under all conditions and for all subjects. However, the biomechanical profiles obtained are consistently repeatable.

Search terms: Drug effects; Driver performance; Sleep deprivation; Alcohol effects; Stimulants; Eye movements; Head movement; Reflexes; Driver reaction time; Test equipment; Biomechanics

HS-012 441 Fld. 3/7

AVAILABLE TECHNIQUES FOR ANALYZING IMPAIRING DRUGS IN BLOOD AND URINE

by M. L. Selzer; P. L. Clayton

Published in *Journal of Safety Research* v4 n4 p179-88 (Dec 1972)

1972 115refs

The feasibility and techniques for analyzing blood and urine specimens for barbiturates, common tranquilizers, narcotics, hallucinogens, amphetamines, and antihistaminic drugs are reviewed. In general, relatively practical and inexpensive methods are available for the detection of these drugs in urine and blood. Since the drugs are usually present in blood in lower concentrations, more sensitive procedures are required. A major deficiency thus far has been the lack of reliable procedures for the quantitative determination of the hallucinogens in body fluids.

Search terms: Blood analysis; Urinalysis; Chemical analysis; Chromatography; Spectrophotometry; Barbiturates; Sedatives; Tranquilizers; Phenothiazines; Antihistaminics; Amphetamines; Narcotics; Hallucinogens

HS-800 753 Fld. 3/7; 3/1

THE INCIDENCE OF DRUGS IN FATALITY INJURED DRIVERS. FINAL REPORT

by E. J. Woodhouse

Midwest Res. Inst., M45000

1972 71p

Contract DOT-HS-119-1-173

Report no. 3540-C

Report for 18 Jun 1971-18 Sep 1972.

Specimens of blood, urine, bile, and alcohol washes of face and fingers were collected from 191 fatally injured drivers in Alcohol Safety Action Project and other cooperating areas. Methods for analysis of blood, urine, and bile for 44 commonly abused drugs were developed. These method consisted of extraction of the fluids, followed by a qualitative thin-layer chromatographic screen. If the screen indicated positives, quantitative confirmation was conducted. Mass spectrometry was conducted if additional qualitative information was necessary. Alcohol washes of face and fingers were examined for evidence of marijuana using a thin-layer chromatographic method. Blood samples were assayed for alcohol content using a gas chromatographic method. Results indicated that 51% of the drivers had ingested alcohol and 33% were legally drunk (blood alcohol content of 0.15% or more). Twenty-four percent of the specimens examined evidenced presence of drugs other than alcohol: 11% evidenced drugs and no alcohol; 13% evidenced drugs and alcohol.

Search terms: Driver fatalities; Drinking drivers; Drugs; Blood analysis; Urinalysis; Skin tests; Blood alcohol levels; Chromatography; Mass spectrometry; Driver intoxication; Alcohol chemical tests; Alcohol Safety Action Projects; Bile analysis

AVAILABILITY: NTIS

HS-820 250 Fld. 3/7; 3/4

THE EFFECT OF MARIJUANA ON DRIVING PERFORMANCE

by F. B. Benjamin

National Hwy. Traf. Safety Administration, N19900

Published in *Current Research in Marijuana*, Academic Press, Inc., New York, 1972, p205-14

1972 18refs

Acute marijuana effects and variables which could be responsible for marijuana-induced accidents are outlined. There is no quantitative test for determining marijuana concentration in blood or urine. Variations are marked, due to psychological characteristics of the subject and the social environment at the time of use. NHTSA is attempting to determine the incidence of drugs in fatally injured drivers using a test based on analysis of alcohol washings of the face and fingers which indicates whether the subject has been exposed to a marijuana environment within one hour prior to the test. A literature survey indicates that marijuana impairs the ability to drive but is not a significant factor in fatal and non-fatal accidents. These observations indicate that either the marijuana smoker is conscious of the impairment and avoids driving, or that he manages to compensate for the deficiency to some extent. Driver records, marijuana usage, and accident rates are tabulated.

Search terms: Marijuana; Driver performance; Drug effects; Risk taking; Driver records; Accident rates; Age factors; Reviews; Drug usage

3/11 Pedestrians

HS-012 411 Fld. 3/11

THE ELDERLY PEDESTRIAN: TRAFFIC SAFETY'S MYSTERY MAN

by E. L. Wiener

Miami Univ., Fla., M29100

Published in HS-012 408, *Triennial Congress on Medical and Related Aspects of Motor Vehicle Accidents (3rd) Proceedings*, Ann Arbor, 1971, p52-6

1971 6refs

Abridged version of *The Elderly Pedestrian—Response to an Enforcement Campaign*, published in *Traffic Safety Research Review* v12 p100-10 (1968).

At about the age of 45 the fatal accident rate starts to climb, and beyond the age of 60 it is nine times that of younger adults. Only part of this may be attributed to the increased liability to death in the event of an accident since similar figures are found for nonfatal accidents. For comparison, the age, fault and blood alcohol level of killed drivers are shown. Contributing factors to the elderly pedestrian fatality rate are sensory defects, pedestrian attitudes, and misunderstanding traffic regulations. The remedy must lie more in traffic engineering and city planning than in behavior modification.

Search terms: Aged pedestrians; Pedestrian accidents; Pedestrian fatalities; Pedestrian age; Pedestrian behavior; Driver fatalities; Driver age; Driver intoxication; Age factor in accidents; Blood alcohol levels; Physical fitness; Aging

4/0 OTHER SAFETY-RELATED AREAS**4/7 Mathematical Sciences**

HS-012 384 Fld. 4/7; 1/2; 3/2

USER-ORIENTED MATHEMATICAL CRASH VICTIM SIMULATOR

by D. H. Robbins; R. O. Bennett, Jr.; B. M. Bowman

Michigan Univ. Hwy. Safety Res. Inst., M40800

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p128-48

1972 14refs

Report no. SAE-720962

Supported by the Automobile Manufacturers Assoc.

As a part of the development of a new six-mass, three-dimensional crash victim simulator, a user-oriented interactive input/output language (OVERLORD) has been developed and is operational at the Highway Safety Research Institute (HSRI). The objective of this tool is to make use of the HSRI and other similar models accessible to persons not highly trained in computer use. The program selects and positions the occupant in the vehicle and then automatically conducts the simulation. This is accomplished in a conversation between the user and the computer. The new model and the OVERLORD program that prepares the input data, executes the computer run, and submits the output back to the user are described. Comparisons between the predictions of the new model, predictions of the older HSRI three-dimensional crash victim simulator, and experimental data are included.

Search terms: Computerized simulation; Dynamic models; Mathematical models; Occupant kinetics; Equations of motion; Occupant vehicle interface; Programming languages; Occupant positioning; Occupant modeling; Seat belt positioning; Human body simulation; Biokinematic models; Impact forces; Degrees of freedom; Inertial forces; Model tests; Acceleration response; Vehicle kinematics; Seat belt loading; Head motion range

HS-012 405 Fld. 4/7; 4/6; 1/3

A REVIEW OF SOME STATISTICAL MODELS USED IN AUTO-

MOBILE INSURANCE AND IN ROAD ACCIDENT STUDIES

by S. Erlander

Published in *Accident Analysis and Prevention* v3 n1 p45-75 (Jul 1971)

1971 98refs

Supported by Sweden Statens Trafiksäkerhetsrad.

Methods for describing the stochastic nature of the number of road accidents and the number of motor insurance claims are reviewed. Models for the number of accidents experienced by an individual, including accident proneness models; models related to a population of individuals; and models for the number of claims are discussed. Models which use other variables in order to explain the number of accidents or claims (such as regression models) are also discussed.

Search terms: Insurance claims; Mathematical models; Statistical analysis; Stochastic processes; Poisson density functions; Probability theory; Accident proneness; Binomial density functions; Random functions; Regression analysis; Accident rates; Accident risk forecasting; Accident studies; Accident analysis

HS-800 764 Fld. 4/7; 5/18

OPERATIONAL HYBRID COMPUTER SIMULATION FOR VEHICLE HANDLING STUDIES. FINAL REPORT

by P. F. Bohn; R. J. Keenan; J. Prowznik

Johns Hopkins Univ., J03600

1972 169p 10refs

Contract DOT-HS-213-2-363

Report no. BCE-T-0367

A hybrid computer simulation for vehicle handling studies has been implemented, checked out, and validated. The

simulation has been programmed to study both solid rear axle and independent rear suspension vehicles. The mathematical model used in the hybrid simulation was supplied by Bendix Research Laboratory. Model validation was accomplished using parametric data for a 1971 Volkswagen Super Beetle. Braking, steering, and combinations of braking and steering were the inputs to the simulated mathematical model for the validation tests. The hybrid computer simulation can be used for general studies of vehicle dynamics. Vehicles other than the Super Beetle can be simulated by using proper descriptive vehicle data.

Search terms: Vehicle handling; Computerized simulation; Mathematical models; Vehicle dynamics; Hybrid computers; Volkswagens; Validation; Braking; Steering; Equations of motion; Computer programs; Degrees of freedom; Rear suspension systems; Tire forces; Coefficient of friction

AVAILABILITY: NTIS

5/0 VEHICLE SAFETY**5/4 Design**

HS-012 402 Fld. 5/4; 5/14

RESEARCH IN AUTOMOBILE CRASHWORTHINESS AND OCCUPANT PROTECTION

by E. A. Kidd

Cornell Aeronautical Lab., Inc., C67200

1972 41p 41refs

Prepared for presentation at the North Carolina State Univ. Spring Symposium, Raleigh, 13-14 Apr 1972.

Occupant protection is provided by proper design of three areas of the vehicle: the interior structure; the occupant restraint systems; and the structure exterior to the compartment. These individual components cannot be considered

independently, because each affects the requirements of the others. Research must define the environment in which the systems will operate. An important consideration in establishing the environment for occupant protection is the speed at impact. It is not practical to provide on-board vehicle systems that will give complete protection from injury in all accidents at all speeds for all vehicles; therefore, the assignment of protection levels and the determination of priorities for research are essential. Information on which to base these levels and priorities can only be obtained from actual accident data.

Search terms: Crashworthy bodies; Crashworthiness; Occupant protection; Automobile interior design; Restraint system design; Structural design; Impact angle; Vehicle size; Impact velocity; Energy absorbing side structures; Computerized simulation; Mathematical models; Restraint system effectiveness; Impact sleds; Head on impact tests; Barrier collision tests; Vehicle vehicle impact tests; Side impact tests; Injury severity index; Deceleration; Anthropometric dummies; Air bag restraint systems; Energy absorbing front structures; Crush tests; Occupant modeling

HS-800 734 Fld. 5/4

REAR END STRUCTURAL CRASHWORTHINESS OF UNITIZED CONSTRUCTION VEHICLES, BASELINE TESTS. FINAL REPORT, PT. 1

by R. L. Anderson; E. Enserink

Dynamic Science, D36000

1972 92p

Contract DOT-HS-046-2-264

Report no. 2310-72-24-Pt-1

Report for Jul 1970-Jul 1972.

Baseline impact tests were conducted to determine the performance characteristics of conventional automobiles in rear

5/4 Design (Cont'd.)**HS-800 734 (Cont'd.)**

end impacts, and to provide a basis for later evaluation of modified vehicles. Three tests were conducted with unmodified 1968 Plymouth sedans. These consisted of longitudinal barrier, 30-degree barrier, and vehicle-to vehicle impact tests. Test speeds were 40 mph for the barrier tests, and 60 mph for the vehicle-to-vehicle test.

Search terms: Crashworthiness; Energy absorbing rear structures; Unitized body construction; Rear end impact tests; Barrier collision tests; Vehicle vehicle impact tests; Test equipment; Fuel tank location; Crashworthy fuel systems; Accelerometers; Acceleration response; Sensors; High speed photography; Data acquisition; Data reduction; Crush tests; Impact velocity; Impact forces; Plymouths; Deformation; Angle impact tests

AVAILABILITY: NTIS

5/6 Fuel Systems**HS-012 433 Fld. 5/6**

AUTOMOTIVE EXHAUST EMISSION LEVELS BY GEOGRAPHIC AREA AND VEHICLE MAKE. A NATIONWIDE SURVEY

by F. L. Voelz; S. I. Weinberg; B. G. Gower

Published in *Journal of the Air Pollution Control Association* v22 n12 p935-42 (Dec 1972)

1972 3refs

Gross average automotive exhaust emission data collected by the Clean Air Caravan during the summer of 1970 showed only slight geographical variations when the specific makes were ignored. When considering specific makes, significant differences were found on an

average emissions basis. Vehicle population-emission distributions showed wide variations in the 50% population levels and in the percent of vehicles with emissions greater than specified values. Hydrocarbon (HC) and carbon monoxide (CO) data are given on a gross basis for the 1970, 1968-69, 1966-67, and pre-1966 model year group vehicles. Average HC and CO emissions and vehicle population-idle emissions distribution curves are included for specific make vehicles in Chicago, Los Angeles, Philadelphia, and Pittsburgh. More than 10,000 vehicles were tested in each area.

Search terms: Exhaust emissions measurement; Vehicle age; Exhaust emission control devices; Automobile models; Carbon monoxide; Hydrocarbons; Exhaust emission tests; Chicago; Los Angeles; Philadelphia; Pittsburgh

HS-012 435 Fld. 5/6; 1/2

A PRACTICAL APPROACH TO THE REDUCTION OF VEHICULAR CARBON MONOXIDE FATALITIES

by W. C. Masemore; R. S. Fisher

Maryland Office of the Chief Medical Examiner, M07800; Maryland Medical-Legal Foundation, Inc., M09600

1973 20p 5refs
Contract FH-11-7399
Report no. SAE-730231

Presented at the International Automotive Engineering Congress, Detroit, 8-12 Jan 1973.

The cause of accidental carbon monoxide (CO) poisonings often involves an interaction of poor vehicular design, construction, and maintenance; faulty repair work; and careless use of the vehicle. To reduce these accidents, ways to prevent, detect, and eliminate vehicular defects leading to the introduction of exhaust gases into passenger compartments must be found. Examples of such methods include redesign of exhaust

systems, implementation of sturdier construction materials, more comprehensive motor vehicle inspection systems, and education of vehicle owners and repairmen on the prevention and detection of defects in exhaust systems and components of vehicle bodies adjacent to the exhaust system. Case studies are presented representing common modes of CO poisoning in vehicular settings and for each case a cause is determined and preventive action is discussed. Suggestions for familiarizing vehicle operators and repairmen with practical means to determine the integrity of the exhaust system and vehicle body are proposed.

Search terms: Carbon monoxide poisoning; Fatality prevention; Accident case reports; Exhaust system failures; Vehicle design; Vehicle maintenance; Vehicle usage; Exhaust system inspection; Mechanic training; Automobile defects; Blood carbon monoxide levels; Passenger compartments; Exhaust pipes; Carboxyhemoglobin; Automobile repair

AVAILABILITY: SAE

5/14 Occupant Protection**HS-012 393 Fld. 5/14; 3/2**

DYNAMIC PERFORMANCE OF CHILD SEATING SYSTEMS

by V. L. Roberts; J. H. McElhaney

Michigan Univ. Hwy. Safety Res. Inst., M40800

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p309-20

1972 12refs
Report no. SAE-720971

This study documents the dynamic performance of a series of child seating systems manufactured since the introduction of the federal standard for child

seating systems, as well as the performance of a new seat concept developed during the research. All of the seats were tested under conditions of frontal impact with additional lateral and rear impacts performed where dictated by the program goals. It was concluded that the use of simulators such as the three and six year old dummies or the semi-articulated infant provides the most appropriate means to load and test child seating devices. These simulators, used in conjunction with head displacement as the criterion of restraint system performance, provide a simple, easy-to-measure test without relying upon dummy acceleration values to establish performance. Additionally, the use of motion limitation as performance criterion will allow the use of a simpler test rig consisting of a bucket or bench seat without requiring a full-body buck complete with instrument panel for testing.

Search terms: Child safety seats; Child seat belts; Impact tests; Restraint system tests; Restraint system effectiveness; Occupant kinematics; Anthropometric dummies; Head motion range; Children; Infants; Human body simulation

HS-012 394 Fld. 5/14; 4/7; 1/2

BIOMECHANICS OF SEAT BELT DESIGN

by J. H. McElhaney; V. L. Roberts; J. W. Melvin; W. Shelton; A. J. Hammond

Michigan Univ. Hwy. Safety Res. Inst.; M40800; Ford Motor Co., F18600

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p321-44

1972 89refs
Contract FH-11-6962
Report no. SAE-720972

Supported in part by the Motor Vehicle Manufacturers Assoc. of the United States, the Dept. of Transp., and Ford Motor Co.

This paper discusses the development of adequate criteria and evaluation methods for seat belt restraint design. These criteria should include the effect of seat belts in abdominal injury as well as head injury. It is concluded that belt load limiters and energy-absorbing devices should limit head-to-vehicle contact, ensure that the lap belt maintains proper contact with the bony pelvis girdle, and limit the belt loads. Studies are made of pulse shape and belt fabrics. Currently available mathematical models are used for the studies included in the paper.

Search terms: Biomechanics; Seat belt design; Abdominal injuries; Head injuries; Seat belt caused injuries; Seat belt tests; Seat belt loading; Mathematical models; Computerized simulation; Occupant modeling; Material tests; Webbing; Impact tests; Seat belt effectiveness; Occupant kinematics; Restraint system design; Head movement; Injury prevention; Occupant vehicle interface; Dynamic tests

HS-012 395 Fld. 5/14; 3/2

EFFECTIVENESS OF SAFETY BELTS UNDER VARIOUS DIRECTIONS OF CRASHES

by D. Cesari; R. Quincy; Y. Derrien

Organisme National de Securite Routiere (France), O20200

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p345-64

1972 5refs
Report no. SAE-720973

Studies of the effectiveness of safety belts were carried out under various directions of crashes, including dynamic sled investigations, destructive barrier tests, and impact tests. The studies showed that three-point belts were effective in frontal impact from 0-30°, but that their effectiveness diminished after 45° because the belt slips off the chest. Three-point belts did not provide protec-

tion for the knees. The studies also pointed out that the anchorage system of the belt is an important factor in its effectiveness.

Search terms: Restraint system effectiveness; Restraint system tests; Impact sleds; Three point restraint systems; Restraint system assembly anchorages; Head on impact tests; France; Severity indexes; Anthropometric dummies; Impact severity; Restraint system anchorage location; Side impact tests; Barrier collision tests; Restraint system failures; Vehicle vehicle impact tests; Dynamic tests; Angle impact tests

HS-012 397 Fld. 5/14

REAR SEAT INFLATABLE OCCUPANT RESTRAINT SYSTEM

by D. J. Romeo; R. A. Rose

Cornell Aeronautical Lab., Inc., C67200

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p412-33

1972 3refs
Contract DOT-HS-053-1-168
Report no. SAE-720975

The objective of this program was to develop an effective inflatable occupant restraint system for unbelted rear seat occupants of full-size motor vehicles. The system developed consists of a crushable honeycomb knee bar to limit femur loads and to help control the head and upper torso trajectory of the unbelted occupants. At speeds below that at which the airbag deploys, protection is provided by energy-absorbing padding on a head bar as well as on the knee bar. Nondeployed protection is provided for crash speeds up to approximately 20 mph in order to satisfy multiple impact considerations, and nonvented side bags are used to provide protection for oblique impacts. In terms of present injury criteria, the restraint was effective

5/14 Occupant Protection (Cont'd.)

HS-012 397 (Cont'd.)

for the 50th percentile adult for crash speeds up to 45 mph for frontal and 30° oblique sled simulated barrier crashes. A performance envelope of crash speed at which protection is provided for other dummy sizes and positions was obtained.

Search terms: Air bag restraint systems; Rear compartments; Restraint system tests; Restraint system design; Barrier collision tests; Knee restraints; Restraint system effectiveness; Impact velocity; Injury severity; Head acceleration tolerances; Chest acceleration tolerances; Occupant kinetics; Human body size; Occupant positioning; Variance analysis; Anthropometric dummies; Angle impact tests; Rebound; Rear seat passengers; Impact angle

HS-012 398 Fld. 5/14

SAFETY PERFORMANCE OF SHAPED STEERING ASSEMBLY AIRBAG

by L. M. Patrick; G. W. Nyquist; K. R. Trosien

Wayne State Univ., W09600

Published in HS-012 325, *Stapp Car Crash Conference (16th) Proceedings*, New York, 1972 p434-71

1972 4refs
Contract FH-11-7607
Report no. SAE-720976

A detailed description of an air bag system for installation on the steering assembly is presented, together with an analysis of its performance during full-scale simulated and destructive collisions. It is shown that the air bag offers the best protection when compared with the performance of lap belts and lap and shoulder belt combinations. This shaped air bag deploys between the abdomen

and the steering wheel and between the head and the steering wheel.

Search terms: Air bag restraint systems; Accident simulation; Sensors; Air bag inflation devices; Restraint system design; Energy absorbing steering columns; Knee restraints; Knee impact areas; Anthropometric dummies; High speed photography; Restraint system effectiveness; Oscillographs; Restraint system tests; Seat belt tests; Four point restraint systems; Head acceleration tolerances; Chest acceleration tolerances; Barrier collision tests; Injury severity index; Fabrics; Air bag restraint system weight; Human body kinematics; Impact velocity; Human body size

HS-012 400 Fld. 5/14; 1/2

BELT RESTRAINT USAGE VS. ACCIDENT SEVERITY

by R. W. Bryant

General Motors Corp., G06600

1972 4p 1ref
Report no. GM-Eng-Pub-A-2910

The more severe the motor vehicle crash injury, the less likely that belt restraints were used. Thus, the commonly quoted belt usage rates are in error when applied to those occupants who are involved in serious accidents. Also it is indicated that belt restraint users have an accident involvement rate about one-third as great as non-users.

Search terms: Injury severity; Seat belt usage; Accident rates; Risk taking; Accident severity

HS-800 725 Fld. 5/14

AIR BAG RESTRAINTS FOR AUTOMOBILE DRIVERS. VOL. 1, SYSTEM DESCRIPTION AND PERFORMANCE. FINAL REPORT

by L. M. Patrick

Wayne State Univ., W09600

1972 226p 53refs
Contract FH-11-7607

Report for Jun 1970-Dec 1971. Vol. 1 only is published; vols. 2-4 are available for consultation in the Technical Reference Div., National Hwy. Traf. Safety Administration.

The research program was conducted to design, develop, fabricate, and evaluate performance of a driver air bag restraint system. The system included the energy absorbing steering column, the special steering wheel, the inflator, the sensor, and the air bag. Crash simulations and crashes were carried out at various velocities with no restraint, with the lap belt only, with the lap and shoulder belt, and with the air bag system. The performance of the air bag system was evaluated by comparing its performance with other protective systems and with the baseline of no protective system according to the injury criteria established in FMVSS 208 and/or the criteria established in this report. Potential injury is appreciably less for the air bag installation than for the standard four point harness, seat belt, or the unrestrained conditions for the forward-force collisions and simulations in this program. Air bag design parameters were also studied through mathematical model simulations.

Search terms: Air bag restraint systems; Restraint system design; Restraint system tests; Restraint system effectiveness; Angle impact tests; Head on impact tests; Barrier collision tests; Steering wheel design; Energy absorbing steering columns; Sensors; Gas generators; Automobile modification; Impact velocity; Anthropomorphic dummies; Mathematical models; Injury severity; Knee restraints; Seat belts; Four point restraint systems; Human body impact tolerances; Test equipment; Computerized film scanning; Oscillographs; Impact sleds; Fabrics; Test facilities; Specifications; Air bag restraint system weight; Laboratory tests; Chest acceleration tolerances; Head acceleration tolerances; Oc-

APRIL 13, 1973

VEHICLE SAFETY

cupant kinematics; High speed photography

AVAILABILITY: NTIS

5/17 Safety Defect Control

HS-820 229 Fld. 5/17

MOTOR VEHICLE SAFETY DEFECT RECALL CAMPAIGNS REPORTED TO THE NATIONAL HIGHWAY TRAFFIC SAFETY ADMINISTRATION BY DOMESTIC AND FOREIGN VEHICLE MANUFACTURERS, JULY 1, 1972 TO SEPTEMBER 30, 1972

National Hwy. Traf. Safety Administration, N19900

1972 36p

This tabulation of safety defect recall campaigns includes the make and model, model year, description of the defect requiring manufacturer's corrective action, number of vehicles recalled, date of notification, and identification number. Automobiles, trucks (including fire trucks) trailers, and motorcycles are included.

Search terms: Recall campaigns; Automobile recall campaigns; Truck recall campaigns; Trailer recall campaigns; Motorcycle recall campaigns; Defect correction; Statistics; Defective vehicles; Defects

AVAILABILITY: GPO

5/18 Steering Control System

HS-800 756 Fld. 5/18; 5/21

INPUT RESPONSE TESTS OF SELECTED SMALL PASSENGER CARS. FINAL REPORT

By D. L. Ivey; R. D. Young; E. French; E. P. Wittich; R. D. Ervin; A. J. Stocker; R. F. Hellmuth; R. H. Gardner; E. R. Post; D. L. Millikan

Texas A and M Univ. Texas Transp. Inst., T18000

1971 225p 7refs
Contract DOT-HS-065-1-077

Five selected open loop, input response tests were chosen to provide a basis for comparing handling and dynamic stability of six selected small passenger cars sold during 1960-1967. The tests incorporated steering maneuvers, steering plus braking maneuvers, and steering maneuvers on a rough road surface. The vehicles in the program were used automobiles that were brought up to and maintained at the manufacturer's specifications. Vehicles were loaded to the manufacturer's specified maximum limit. All but one test maneuver was conducted at the manufacturer's recommended tire pressures. One test maneuver used an automatic controller in its execution, the others incorporated use of passive devices to constrain driver steer and brake inputs for simple step type control inputs. Data reduction procedures are described. Test results for each vehicle are portrayed graphically.

Search terms: Compact automobiles; Automobile handling; Automobile stability; Steering tests; Braking; Used automobiles; Performance tests; Dynamic tests; Tire inflation pressure; Automatic steering control; Automatic braking; Data reduction; Pavement surface texture; Automobile models; Test equipment; Test facilities; Turning; Automobile tests; Yaw; Steady state

AVAILABILITY: NTIS

5/22 Wheel Systems

HS-820 227 Fld. 5/22

HOLOGRAPHIC TECHNIQUES FOR NONDESTRUCTIVE TESTING OF TIRES. INTERIM REPORT

by H. L. Ceccon

National Hwy. Traf. Safety Administration, N19900

1972 74p
Contract HS-203
Report no. DOT-TSC-NHTSA-72-4

Holographic interferometric techniques were used in a development program to evaluate the feasibility of the technique in the nondestructive testing (NDT) of commercial automobile tires. Separations and voids were located reliably. Defects other than separations and voids were detected in some cases. A program is currently underway in which off-the-shelf passenger tires are first inspected holographically as well as by other NDT methods, then subjected to the Motor Vehicle Safety Standard 109 endurance or high speed tests, reholographed and then sectioned analytically. The objective of the program is to correlate non-destructive test data with tire failure. At the beginning of the inspection program poor correlation between holographic detection of defects and failure analysis existed, but with experience and an improved marking system the correlation in detecting separations is currently running at approximately 95%.

Search terms: Tire cords; Holographic interferometry; Holography; Tire test equipment; Tire defects; Tire tread separation; Defective tires; Tire tests

AVAILABILITY: NTIS

HS-820 228 Fld. 5/22

AN INFRARED EXPERIMENT ON A ROAD WHEEL DURING AN FMVSS 109 TYPE COMPLIANCE TEST. INTERIM REPORT

by S. N. Bobo

National Hwy. Traf. Safety Administration, N19900

1972 55p 3refs
Report no. DOT-TSC-NHTSA-72-3

Report for Mar-Jun 1972.

5/22 Wheel Systems (Cont'd.)**HS-820 228 (Cont'd.)**

This report outlines an experiment conducted at a compliance center to gain information on relating a tire's thermal performance during testing to tire failure. To substantiate this correlation, the

instrumentation used is described as well as the method of data retrieval. The tires were inspected by various non-destructive tests before and after compliance testing. The population of inspected tires was inadequate for general conclusions about the relationship between temperature and failure but the data obtained indicates the technique shows promise. The experiment found a definite relationship between the number of tires

being run on a test wheel and the thermal stress applied to those tires.

Search terms: Tire temperature tests; Tire test equipment; Compliance tests; Nondestructive tests; Tire failures; Thermal stresses; Durability tests; Retreaded tires; Design of experiments; Tire temperature

AVAILABILITY: NHTSA

*U.S. GOVERNMENT PRINTING OFFICE 513 005

NHTSA CONTRACT AWARDS

Abstracts are arranged by contract number (e.g. DOT-HS-018-3-597)

DOT-HS-026-3-617

TIRES FOR VEHICLES OTHER THAN PASSENGER CARS. HIGH SPEED TESTS — PROPOSED FMVSS NO. 119

Compliance Testing, Inc.
P. O. Box 351
Ravenna. Ohio 44266

23 Feb 73 to 24 Jul 73

\$2,600

The objective of this effort is to support rulemaking activities related to proposed Federal Motor Vehicle Safety Standard No. 119, Docket 71-18, by obtaining high speed laboratory test data for tires

with four load ranges to provide a broad data base to finalize this proposed standard. Tires tested are to be in specified sizes for the following vehicle types: special trailer, TR trailer, motorcycle, light truck, motor scooter, mobile home.

DOT-HS-204-3-611

BI-LEVEL MICHIGAN/ILLINOIS MOTORCYCLE DATA

Opportunity Systems, Incorporated
1330 Massachusetts Avenue, N. W.
Washington, D. C. 20005

This contract is awarded by the Small Business Administration under the authority of Section 8(a) of the Small Busi-

ness Act (15 USC 637(a)), and will be administered by the Department of Transportation, National Highway Traffic Safety Administration.

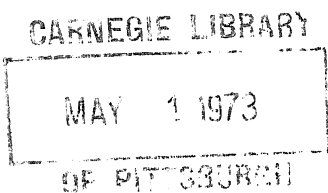
9 Feb 73 to 10 Jun 73

\$34,525

The NHTSA has collected approximately 5,000 "Bi-level" police reports of motorcycle accidents from the States of Michigan and Illinois. The purpose of these reports is to obtain information which can be analyzed to estimate the effectiveness of the Highway Safety Standard on Motorcycles. The purpose of the contract is to convert the source documents to an automated file. Products of this effort are to be: an instruction manual, the data tape(s), printouts.

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